ATMOS 6910-019: Land-Atmosphere Interactions
Spring Term 2013


Course Description:
The land and the atmosphere are two key components of planet Earth. They interact in different ways, at various timescales, to affect the climate, weather, and the air that we breathe in. In fact, we spend almost all of our time at the interface between the land and the atmosphere (except for the few astronauts among us). At this interface, energy, momentum, and mass are exchanged constantly. Of particular societal and scientific interest are fluxes of water, carbon, and pollutants. We will examine how the atmosphere impacts such fluxes, and how such fluxes, in turn, affect the atmosphere. The class combines lectures, computer labs, and perusal of the primary literature to arrive at a multi-faceted understanding of land-atmosphere interactions.

(Photocredit: J. Lin)

Prerequisites:
- College-level physics and calculus
- Eagerness to learn!

Scheduled class time:
Mondays and Wednesdays: 3pm to 4:20pm in WBB 711
WBB 711 is a computer lab. There will be occasional computer labs in class, in which students will interact with the computer-based models or data analysis tools. The objective is to have students come out of the class with concrete skills in using computer-based tools.

**Instructor**

*John C. Lin*

Associate Professor, Dept. of Atmospheric Sciences

E-mail: John.Lin@utah.edu

Phone: (801)581-7530

Office: WBB 721

**Office Hours**

By appointment

**Course Objectives**

- Learn about physical models of the land surface and the atmosphere, and how they are coupled
- Get experience in developing computer models to describe phenomena at the land-atmosphere interface and simulating them numerically to understand the essential physics
- Read the primary literature (i.e., scientific papers) on the relevant topics
- Practice oral presentation skills by presenting the papers to the class
- Opportunity to carry out a mini project analyzing science-quality data to answer specific question(s)

**Topics that Will be Covered in Class**

1) Global energy balance models
2) Gaia Hypothesis and Daisyworld
3) Energy balance at land surface
4) Coupled land surface-atmospheric boundary layer models
5) Effect of land use change
6) Land-atmosphere carbon exchange
7) Air quality-relevant pollutant emissions
**Computer-based Modelling and Data analysis skills:**
This course will introduce the students to modelling and data analysis using R ([www.r-project.org](http://www.r-project.org)). R is a fully-functional, free, and open-source software that runs on multiple platforms (e.g., Mac OS, Windows, Linux). Furthermore, R is gaining in popularity due to the powerful data analysis packages that have been contributed by users all over the world. This course will incorporate computer labs in which students will gain “hands on” experience in learning and exploring geoscience phenomena using models constructed in R. The data analysis component will allow students to carry out statistical and time series analyses using measurements or output from other models.

**Grading**

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<thead>
<tr>
<th>Component</th>
<th>Weight</th>
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<tbody>
<tr>
<td>Problem Sets:</td>
<td>25%</td>
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<tr>
<td>In-class Paper Presentations:</td>
<td>30%</td>
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<tr>
<td>Final Project:</td>
<td>40%</td>
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<tr>
<td>Class Participation:</td>
<td>5% (attendance and participation)</td>
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**Textbook**

No textbook. The lectures and the accompanying notes will serve as the core of the course.